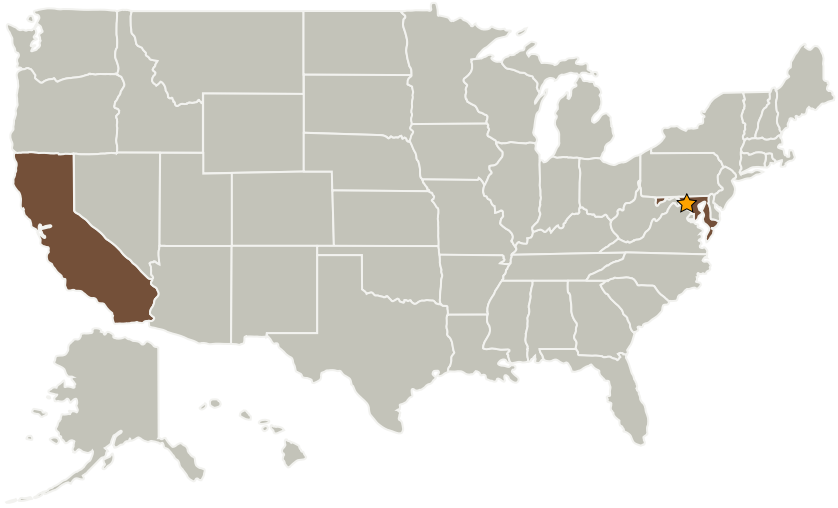
A Near-Infrared Photon Counting Camera for High Sensitivity Astronomical Observation, Phase II

Completed Technology Project (2007 - 2009)

Project Introduction

The innovation is a Near Infrared Photon-Counting Sensor (NIRPCS), an imaging device with sufficient sensitivity to capture the spectral signatures, in the wavelength range 0.9-1.7 um from very faint extra-solar targets and events with high resolution. The NIRPCS will have near zero read noise and dark rates below the read noise to support photon counting for frame capture times as high as 10 seconds. Up to 10/5 frames can be sequentially captured and digitally averaged. Important NASA applications for the NIRPCS include spectral measurements on extra-solar planets in search of water and bio-markers and measuring the dynamics of galaxies at high redshift to better understand the formation process. The technical objectives of Phase II are centered on more focused study on the behavior of the TE photocathode at the very low cooling temperatures anticipated for the ultimate implementation of this sensor technology by NASA for the astronomy application. The modeling results of the Phase I effort showed that reduction of the electric field in the InP, due to applied cathode bias, reduced the bias dependant hole avalanche and absorber generation contributions to the cathode dark current. Factors of 3.8x and 48.2x reduction in dark current resulted for two redesigned cathodes at an operational temperature of 200K and +2V cathode bias. This occurred by redesign of the epitaxial structure in which the p-doped cap layer was eliminated. However, too much reduction of the electric field in the InP may also reduce the escape probability of hot electrons in the InP to vacuum thereby reducing quantum efficiency. Therefore a technical Phase II objective is to execute a design of experiment (D.O.E) to determine the best epitxial design for maximum quantum efficiency and reduced dark current.

Primary U.S. Work Locations and Key Partners



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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Intevac, Inc.	Supporting Organization	Industry	Santa Clara, California

Primary U.S. Work Locations	
California	Maryland

Project Transitions

December 2007: Project Start

December 2009: Closed out

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes